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Canadian Association of Radiologists Journal 61 (2010) 54–57

CANADIAN ASSOCIATION OF RADIOLOGISTS JOURNAL

www.carjonline.org

Canadian Residents' Corner / Coin canadien des résidents en radiologie

Answer to Case of the Month #159 Traumatic Pseudoaneurysm Diagnosis and Treatment

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Clinical Presentation

A 25-year-old man presented to the emergency department after having been stabbed in the left axilla, which resulted in a 3-cm laceration near the posterior axillary line. The patient was hypotensive but otherwise stable. A computerized tomography (CT) of the chest was obtained and did not reveal any arterial trauma. Ten days later, the patient presented with a hematoma in the left axilla and severe pain around the healed laceration. The patient underwent CT angiogram (CTA), which demonstrated a subclavian artery pseudoaneurysm (PA) (Figures 1 and 2). Given these findings, left subclavian angiography was performed (Figure 3), followed by successful coil embolization of the left circumflex scapular artery (Figure 4). Crossing the PA was attempted but was not successful, and it was believed that the vessel was completely transected. Two days later, the patient's symptoms had improved considerably, and CTA was performed as routine follow-up to the embolization (Figure 5).

Diagnosis

The diagnosis was persistent left axillary PA anteriorly, fed by the left circumflex scapular artery and back-fed by the left suprascapular artery, and requiring subsequent embolization of the back-feeding artery. Follow-up ultrasound confirmed PA thrombosis.

Radiologic Findings

Initial CT images revealed an enhancing collection anterior to the left scapula and posterior to the left humerus, which was centered within the left latissimus dorsi and teres major muscles, consistent with a PA (Figures 1 and 2). The circumflex scapular artery arising from the subclavian artery abruptly truncated into this collection, which suggests that it was transected and was the source of the PA. The more distal axillary and brachial arteries were widely patent.

Initial angiography confirmed the CTA findings with the circumflex scapular artery being the source of the PA (Figure 3), therefore, coil embolization of this vessel was performed (Figure 4). No appreciable back filling was seen.

CTA performed 2 days later demonstrated persistent flow in the PA, which was slightly smaller in size. This vessel was now being back-fed from the suprascapular artery (Figure 5). An angiogram confirmed this finding. Successful embolization of the suprascapular artery, which provided back-filling of this left shoulder PA was performed. Follow-up ultrasound confirmed successful PA thrombosis.

Discussion

PA, also known as a false aneurysm, is an outpouching of a blood vessel caused by disruption of one or more layers of its wall, rather than an expansion of all wall layers, as is the case in a true aneurysm [1]. PAs usually develop after penetrating trauma from stab wounds or gunshot wounds [2,3]. Subclavian arterial injuries are uncommon and difficult to detect because of the relative inaccessibility of the vessels [4]. Colour-flow duplex ultrasonography is the ideal noninvasive test for identifying PA, because it is inexpensive, completely noninvasive, and does not require administration of contrast medium [2,4]. However, it is highly user dependent, and certain vessels, such as the subclavian artery and

Key Words: Coil embolization; Computed tomographic angiogram; Digital subtraction angiography; False aneurysm; Magnetic resonance angiography; Pseudoaneurysm diagnosis; Pseudoaneurysm; Subclavian pseudoaneurysm; Traumatic pseudoaneurysm.

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0846-5371/$ - see front matter
doi:10.1016/j.carj.2009.05.012

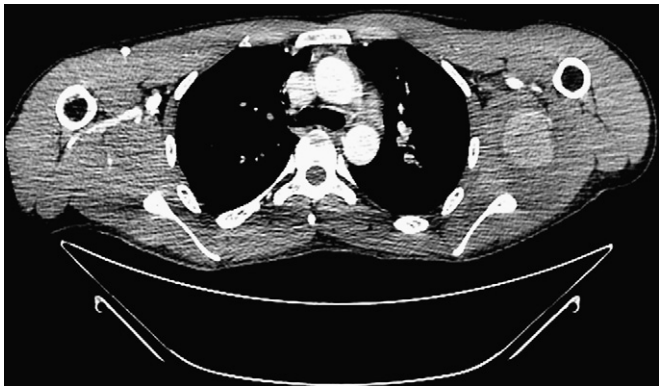

Figure 1. Postcontrast axial computed tomography images of the chest demonstrate an enhancing pseudoaneurysm within the left axilla.

the profunda femoris, are more challenging to image by virtue of their location [2]. A large hematoma or the patient's body habitus may also limit the detail of this modality [2]. In such cases, cross-sectional or conventional angiography becomes the diagnostic study of choice. PA is usually characterized by residual contrast media retention in the lesion long after the arterial phase of diagnostic angiogram is over [1].

Conventional digital subtraction angiography (DSA) remains the current diagnostic criterion standard for the diagnosis of PA and offers the possibility of performing endovascular interventions [5–7]. Preoperative anatomic evaluation of the arterial pathology is essential in planning the endovascular procedure. However, DSA is an invasive procedure that carries a small but finite risk of serious complications, for example, hematoma at the puncture site, arterial spasm and ischemia, thrombosis of the vessel used to access the arterial system and subsequent embolization [8,9]. Opponents of DSA have also cited high cost, time-consuming delays, and the need for specialized equipment as drawbacks to routine use of DSA in clinically stable patients with penetrating proximity injuries [4]. With recent advances in multidetector CT technology, CTA has emerged as a promising technique for rapid and less-expensive screening evaluation of neurovascular injury, although its use in definitive diagnosis remains controversial [10]. Helical CTA has been proven to have a high diagnostic performance in the detection of traumatic lesions such as PAs in large arteries of the extremities [9,11]. It does, however, have certain drawbacks, including lower spatial resolution, imaging artifacts, and the inability to immediately intervene after diagnosis [9,11].

Figure 2. Three-dimensional reconstruction from post–contrast axial computed tomography of the chest, showing the traumatic pseudoaneurysm and feeding circumflex scapular artery.

Figure 3. Initial diagnostic angiogram of the left subclavian artery, confirming the computed tomographic angiogram findings with the circumflex scapular artery feeding the pseudoaneurysm.

In patients with arterial trauma who present with associated signs and symptoms and in whom nonsurgical therapy is an option, helical CTA may be unnecessary, because conventional angiography will still be required before transcatheter therapy. However, not all patients who present with these strongly suggestive signs of vascular injury eventually are proven to have significant arterial injuries [9]. Therefore, in patients with strongly suggestive signs of vascular injury, helical CTA may be helpful as a triage examination to direct patients to surgical or endovascular

Figure 4. Digital subtraction angiographic image after coil embolization, revealing the coils within the circumflex scapular artery with no enhancement in the pseudoaneurysm.

Figure 5. Follow-up with imaging two days post-coiling axial computed tomographic angiography (A) and digital subtraction angiography (B) demonstrating the coils, but persistent filling of the pseudoaneurysm with contrast from the suprascapular artery (arrow).

therapy [9]. In addition to DSA and CTA, magnetic resonance angiography (MRA) has also been used to detect arterial injuries even though it may be difficult to obtain in unstable acutely injured patients [9,10,12]. Interestingly, radiologists at some centers believe that contrast-enhanced MRA will be the preferred technique in the preoperative diagnosis of vascular disease in the near future [10,12].

Treatment options for traumatic PA are many. Coil embolization is useful for a PA, as is stent graft repair and local compression or ablation with thrombin. The vessel embolized in this case was too small for a stent graft. If the PA had a relatively narrow neck, as opposed to a transection, then thrombin injection could have been considered as an alternative treatment. However, the CTA demonstrated a transected vessel and thrombin ablation in that setting was shown to have a very high recurrence rate, as opposed to a narrowed neck PA with flow distally [13,14]. Open surgical repair is currently considered the criterion standard for treatment. Coil embolization offers the advantage of precise positioning, hence coils are favored over other embolotherapy agents such as balloons and tissue adhesives [15]. Embolization requires cannulation of the target artery with a catheter that is then used to deliver coils that occlude not the PA itself but rather the artery proximal and distal to the PA [15]. Identifying both of these vessels is key to adequate treatment. In our case, the distal feeding vessel (left suprascapular artery) was not easily visualized on the initial study; therefore, the PA persisted and repeat intervention to coil this vessel was needed for adequate hemostasis. The success rate for transcatheter embolization was reported to be between 85% and 100% [15]. Although open surgical repair is the criterion standard, coil embolization is an alternative that may provide maximal benefit to poor surgical candidates or patients in which vessels are difficult to access surgically, such as the subclavian artery in our case [15]. Also, because of the familiarity and ease of performing catheter-based procedures in dealing with PAs, more PAs are currently being treated with endovascular embolization [16].

In summary, although DSA remains the current criterion standard examination for diagnosing PA, it is costly and often impractical as a screening modality. The sensitivity and specificity of CTA are high for detection of a PA, and, because it is a rapid, less-expensive technique, it may prove to be a good alternative to DSA for initial examination of patients

with arterial trauma. However, the inability to intervene may preclude CTA as an alternative in the acute setting. Interventional techniques, for example, coil embolization, as an alternative to surgery can decrease the morbidity, mortality, and cost involved in the care of patients with vascular disease and have positive medical and economic implications.

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